


# Indispensable Source of Risk Contagion With Big Data Analysis From a More Comprehensive View on Shadow Banking


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## ABSTRACT

Although shadow banking widely exists in the financial systems of various countries, their definitions vary significantly due to specific economic and financial characteristics. This paper classifies Chinese shadow banking into six categories: securities, trust, private lending, banking, fund, and insurance. The AR-GARCH-DCC model is used to measure systemic risk spillover through from an industrial and institutional perspective. The network topology index is employed to analyze risk contagion and further explore influencing factors. Firstly, based on the results of the AR-GARCH-DCC, the estimated dynamic volatility ( $\sigma$ ) indicates that shadow banking risk spillover is time-varying, especially in trust and securities. Second, according to the static risk spillover analysis, various institutions play different roles and can transform between risk spillovers and overflowers. Thirdly, eigenvector centrality, leverage, assets, CPI, and macroeconomic prosperity significantly impact shadow banking systemic risk spillover.

## KEYWORDS

AR-GARCH-DCC, Shadow Banking, Systemic Risk Spillover

The outbreak of the financial crisis in 2008 significantly impacted both financial and economic systems in the world. Since then, scholars have increased their attention to systemic risk measurement (Adrian et al., 2008; Girardi et al., 2013; Gary et al., 2007; Acharya et al., 2017; Brownless et al., 2017). The inherent instability of the financial system depends on financial fragility, bounded rationality of market entities, and asset price volatility. Financial risks arise successively among institutions, economies, and regions based on the payment and clearing systems among financial institutions, interbank exposure, and common exposure formed by holding the same assets. While much research has traditionally concentrated on the banking system, which is the core of the financial system, shadow

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banking, often dissociated from the regulatory framework, poses substantial risks. Moreover, shadow banking spans multiple industries and institutions horizontally, increasing its infectivity. If high-risk shadow banking becomes uncontrollable, it may lead to systemic risk. Therefore, shadow banking is an indispensable component of the financial system when comprehensively measuring systemic risk.

While shadow banking is widespread, its definition varies among different countries. Scholars closely monitor the development of shadow banking and strive to formulate definitions based on theoretical frameworks and observational findings (McCulley, 2007; Krugman, 2008; Adrian & Shi, 2009; Gorton, 2009; Tucker, 2010; Pozsar et al., 2010). Various countries have different views on shadow banking due to differences in their financial structures resulting from distinct levels of financial development. The Financial Stability Board (FSB) offers a general definition of shadow banking as credit intermediaries operating outside regulatory frameworks, capable of causing arbitrage and systemic risks. However, China's shadow banking exhibits unique characteristics beyond the general situation. It has three main aspects: (a) credit intermediaries without financial licenses or supervision, such as third-party financial institutions; (b) credit intermediaries without financial licenses and subject to limited supervision, such as financing guarantee companies; and (c) instruments within financial licenses but lacking adequate supervision, such as securitization. An accurate definition of shadow banking, which serves as the cornerstone for subsequent measurement, is urgently needed.

Shadow banking can alleviate the financial pressure of small and medium-sized enterprises. Research on this issue mainly focuses on scale measurement (Harutyunyan et al., 2015; Sheng & Soon, 2015; Chen et al, 2018; Zhu, 2018; Allen et al., 2018; Acharya et al., 2020), macro-prudential supervision (Jeanne & Korinek, 2014; Cizel et al., 2016; Fève et al., 2019), correlation with monetary policy (Gertler & Karadi, 2013; Illes & Lombardi, 2013), maturity mismatch (Crotty & Epstein, 2008), and the positive and negative impacts on economic development (Allen et al., 2019; J. Du et al., 2017). However, studies have disregarded comprehensively monitoring and controlling various risks in real time. To fill in this gap, this research aims to use the 2020 China Shadow Bank Report to construct a framework containing traditional institutions like banking, insurance, securities, and also shadow banking entities, including trust, private lending, and fund. Systemic risk is measured by indicators such as  $\Delta CoVaR$  according to the AR-GARCH-DCC model. Regarding the suitable regulatory system, few studies have concentrated on risk transmission from the perspective of a complex network. In this regard, this research constructs the spillover network using the generalized variance decomposition method (Diebold & Yilmaz, 2012), describing the scale and direction of risk contagion among institutions in detail. Using network topology indicators, it explores the impact of macro and corporate-level variables, thereby establishing a panel regression model to identify the factors.

This paper has the following contributions. First, in alignment with the 2020 China Shadow Bank Report, it provides a more critical, reliable, and applicable classification of shadow banking. It defines the main categories of securities, trust, insurance, private lending, fund, and banking to construct systemic risk spillover measurements at both industrial and institutional levels. Second, it accurately estimates the risk spillover using the AR-GARCH-DCC, unlike the quantile regression with its incomplete analysis of the residual hypothesis, ignoring the GARCH effect. Therefore, the nonlinear structure would fail in timely identification by mistakenly describing the correlation between the series. The AR-GARCH-DCC model can thus be used to determine  $\Delta CoVaR$  systemic risk value, compensating for the defects of traditional models. Third, the measurement of risk spillover indicators covers the volatility and correlation of asset yields. Previous studies have mostly adopted  $\Delta CoVaR$  and  $MES$ . This paper calculates the volatility and correlation at the same time for comparative analysis. Fourth, the topology of spillover and factors of spillover are explored to form regulatory opinions and recommendations.

The paper is organized as follows: Section 2 summarizes the literature. Section 3 describes the boundary, mechanism, and risk characteristics composition of shadow banking. Section 4 covers the methodology, and Section 5 presents the data and descriptive statistics. Section 6 discusses the

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